Alcohol risk environments, vulnerability and social inequalities in alcohol consumption

Niamh K Shortt*, Centre for Research on Environment, Society and Health, School of Geosciences, University of Edinburgh, Drummond Street, Edinburgh, UK, EH8 9XP

Esther Rind, Institute of Occupational and Social Medicine & Health Services Research, University Hospital Tuebingen, Tuebingen, Germany

Jamie Pearce, Centre for Research on Environment, Society and Health, School of Geosciences, University of Edinburgh, Drummond Street, Edinburgh, UK, EH8 9XP

Richard Mitchell, MRC/CSO Social & Public Health Sciences Unit, Institute of Health and Wellbeing, University of Glasgow, Glasgow, UK,
G2 3QB

Sarah Curtis, Department of Geography, Durham University, Durham, UK, DH1 3LE

* Corresponding author

Abstract

Alcohol and alcohol related harm are key public health challenges. Research has shown that individual level factors, such as age and sex, are important predictors of alcohol consumption, but such factors provide only a partial account of the drivers of consumption. In this paper we argue that individual level factors *interact* with features of the 'risk environment' to increase the vulnerability of individuals to such environments. Features of the alcohol 'risk environment' include the density of alcohol premises in a neighbourhood. Previous research has shown that neighbourhoods with a higher density of alcohol outlets have higher levels of both alcohol consumption and alcohol related harm. There has however been a distinct lack of attention paid to the differential ways in which particular socio-demographic groups may be more vulnerable to such 'risk environments'. In this paper we address the risk environment through a primary focus on the local supply and availability of alcohol products (captured using a measure of outlet density) and the relationship with the harmful use of alcohol. Using responses to the Scottish Health Survey (2008-2011) we explore vulnerability through the interaction between individual level socio-economic position, measured using household income, and environmental risk to assess differential social vulnerability to such environments. We report findings showing that those in the lowest income groups may be disproportionately affected by outlet density. This evidence suggests that risk environments may not affect us all equally and that there may be socially differentiated vulnerability to such environments.

Key words: *Alcohol, outlet density, risk, vulnerability and health inequalities*

Background

This paper presents research that seeks to expand our knowledge on the geographies of alcohol by taking an integrated perspective, incorporating assessment of geographical dimensions of risk and their relationship to individual behaviour. Recent literature from a health geography perspective emphasises how space can be viewed as constituting risk environments where the built and social dimensions of places can also be manipulated as means of risk governance and minimisation (Herrick 2011). In risk management policy, a distinction has often been made between environmental and lifestyle risks (Gabe 1995; Lupton 1993). Environmental risk management has tended to focus on toxins in the material environment, for example in the case of risks to pulmonary health, these include air pollutants, emissions from landfill waste or those produced by radon gas, or 'second hand' tobacco smoke. On the other hand, lifestyle risk risk management has been driven by discourse regarding the individualisation of risk; individuals are expected to regulate their own behaviours.

In this paper we consider alcohol consumption as an individual behaviour that is influenced by environmental factors and report on work to assess how some aspects of the 'risk environment' at a local level, which are not subject to very rigorous governance, may interact with individual risk behaviour. Annually, across the globe, in excess of 3 million deaths are attributable to alcohol, with alcohol related to over 200 health conditions (WHO 2014). Within Europe excessive alcohol consumption places a substantial burden on society and national health care systems (Angus et al. 2017). Drinking patterns however vary by country and in the UK per capita consumption of alcohol (age 15+) stands at 11.6 pure litres, whilst falling this remains

higher than the European WHO region average of 10.9 litres (WHO 2014). Within the UK there are also differences by country with a fifth more alcohol sold per adult in Scotland than in England and Wales. Alcohol has been identified as a key factor in explaining the significant differences in health outcomes between Scotland and the rest of the UK, and is also implicated in country's high (and rising) levels of health inequalities. Whilst the focus of this paper is on Scotland, Scotland is not unique in identifying 'high risk' drinking as a priority issue for public health. Although in Scotland, since 2009, there has been an 8 percent reduction in alcohol consumption per adult, sufficient alcohol is being sold for each adult in the country to drink more than 20 units each week, which is six units (43 percent) more than the current guidelines (1 unit is roughly equivalent to half a pint (284ml) of 3.5 percent strength beer or a single measure (25ml) of spirit, strength 37.5 percent. Units are calculated as strength (ABV) x volume (ml) ÷ 1,000 = unit). In this paper we examine whether those living in neighbourhoods of high alcohol outlet density exhibit different patterns of alcohol consumption patterns compared to those in areas of low alcohol outlet density. In a novel and significant addition to the literature we explore whether or not the risk environment shapes consumption patterns equally amongst all socioeconomic groups.

Geographers have for some time now been exploring alcohol environments, focussing on the political, economic, social, cultural and spatial processes that shape such environments and responses to them (Jayne et al. 2011). Related research has included both empirical, quantitative measures of the alcogenic environment and its relationship to alcohol-related harm, as well as a critique of such epistemological framing of alcohol as a medical issue (Jayne et al 2011b). Topics such as legislation

and policy(Jayne, Valentine & Sarah L Holloway 2011b), the night-time economy (Demant & Landolt 2013), gentrification (Mathews & Picton 2014) and historical patterns of licensing (Beckingham 2012) have been key features of the research as well as those focussing on identity (Nayak 2003), drinking cultures (Jayne, Valentine & Gould 2012), lifestyle and the gendered nature of alcohol (Thurnell-Read 2013).

Whilst geographic literature suggests that 'place matters' for alcohol consumption and health-related outcomes, discourse regarding the privatisation of risk has shifted both political and public rhetoric towards individual responsibility and deviance from the 'norm' (Glasgow & Schrecker 2016). Although Giddens (1999) and Beck (1992) have been criticised for overemphasising the individual as an autonomous subject, their notions of risk do help us to refocus on positions regarding individual responsibility and risk governance, and to consider the changing dimensions of risk. Giddens argued that we have seen a transition from external risk to 'manufactured' risk, with risk moving from that which could be seen as outside the scope of society to that which has been created (Giddens, 1999). Whilst such an argument has been used to explore the rise of technology, it could also be applied to public health and the ways in which we define personal responsibility and unintended consequences of the risk society. Since the 1970s conflicting political, social and industry-related perceptions of risk and governance suggest two broad arguments regarding responsibility. On the one hand the individual is seen as responsible for managing lifestyles and associated health risks. Supporting such a framing of governance the alcohol industry, through Corporate Social Responsibility (CSR) activities, promote initiatives such as responsible alcohol consumption, server responsibility and the dangers of both drink driving and underage drinking (Babor & Robaina 2013). On

the other hand, the emergence of a 'new public health' in public policy embraces a social determinants model that recognises risks in material and social living conditions, emphasises societal responsibility for these risks and suggests regulatory or statutory interventions at a population level. A more structuralist interventionist approach may therefore include limiting the availability of alcohol, taxation on alcoholic beverages and restrictions on alcohol advertising.

Interventions that focus on the former, embracing individual responsibility and behavioural change adopt theories of 'rational decision making' and 'reasoned action', seeing risk taking decisions as largely voluntary, products of health beliefs and therefore context free (Rhodes 2002). In such models of behaviour, risk plays a central role but is confined to a subjective cost-benefit analysis based on conscious actions that pay little attention to underlying influences (van der Plight 1998). Behaviour change led interventions have focussed on education, for example on improving public understanding of alcohol units and more recent attempts to highlight the calorie content of alcohol and campaigns to 'go sober' (examples from the UK include Macmillian's 'Go sober for October' and Alcohol Concern's 'Dry January'). Room (2011) charts the rise of the individualised approach, arguing that commercial interests and free-market ideologies have pushed alcohol, and public health responses to related problems, towards a more open market. This rise resonates with Beck's view of the economy as a system for the distribution of material benefits and risks (Beck, 1992) and Giddens' discussion of the shift from external risk to manufactured risk (Giddens, 1999). A free-market view has however failed to recognise the complexity of the drivers behind alcohol misuse and instead creates two distinct camps; the 'alcoholic' and the social drinker (Room 2011) with moral values attached

to each, negative connotations with the former and positive, socially acceptable values with the latter. Such moralisation of drinking practices, and in particular intoxication, is demonstrated not only in behaviour change interventions, but also in advertising campaigns of the alcohol industry promoting 'responsible drinking' thus placing the problem 'with the use rather than the product' (Wolburg 2005, p176). Furthermore research suggests that the alcohol industry has misrepresented evidence of risk using three strategies; denial or omission, distortion and distraction, thus misleading the public and policymakers regarding the risk of alcohol (Petticrew et al. 2017). Related to such misrepresentation public health information programmes emphasising responsibility are promoted, with weak evidence supporting their effectiveness (Hawkins et al. 2012). Indeed Babor et al. (2003) found little or no impact of these campaigns on population level alcohol use. Indeed Jayne et al (2012) have argued that the dominance of units in such campaigns is flawed. Their research showed that people chose to ignore units, with their use as a public health tool *'far removed from the majority of people's practices and experiences'* (Jayne, Valentine & Holloway 2012, p.838).

Such behaviour led intervention population strategies have been termed 'superficial', interventions that simply encourage individuals to change their behaviours (Rose 1992). Most importantly however is the lack of attention paid to health inequalities by such interventions. Behaviour change led approaches fail to appreciate how context within the risk environment, and vulnerability to such environments, interact to produce and reinforce health inequalities (Barnett et al. 2016). Within such interventions 'responsibility' has become the buzzword within a system that has been *'built … around a relatively free availability of alcohol'* (Room, 2011, p. 147).

Rhodes (2009) refers to this as 'contingent causation' with harm contingent upon social context and the interactions between the individual and the environment. Evidence however would suggest that such interventions can widen inequalities (Buck & Frosini 2012). Here is where alcohol harm poses a particular challenge. Whilst for other health behaviours we see the expected social gradient for consumption, mirrored by the social gradient in harm (e.g. for tobacco lower income groups are more likely to smoke and also more likely to die from smoking related illnesses) for alcohol lower socioeconomic groups report consuming the same or less on average than higher SES groups but suffer more from alcohol related harm when compared with higher SES groups (Lewer et al. 2016). This has become known as the Alcohol Harm Paradox. Several theories have been suggested including that lower SES groups have unique consumption patterns (e.g. more likely to binge drink), disproportionately underreport consumption, have a greater clustering of unhealthy behaviours (e.g. alcohol interacting with smoking and sedentary behaviour) and have poorer access to health care (Bellis et al. 2016). There has however been little focus on how social and material aspects of the broader structural risk environment play a role in shaping unequal drinking behaviours. Mennis et al. (2016) call for research that focuses on 'inequities in risky substance use environments' and the implications of this for disparities in related outcomes. Alcohol outlet density may play a role here in shaping particular consumption patterns amongst different income groups. In this paper we analyse four drinking outcomes to explore the association with density by income group for each outcome. An improved understanding of these contextual effects may help drive forward more radical population strategies that change the context in which the behaviours occur. Such 'radical' strategies would instead 'aim

to remove the underlying impediments to healthier behaviour, or to control the adverse pressures' (Rose 1992), p. 100).

Applied to alcohol-related problems a more social determinants informed radical strategy would aim to change the underlying causes, the broader structural drivers of alcohol consumption, and in particular focus on reducing any inequalities in alcohol-related harm. Such radical population strategies may however compete with public values around personal freedom and self-control, nevertheless several countries have begun to pursue interventions regarding pricing and taxation, drink driving and marketing. Since 1999 devolution within the UK (the transfer of powers from central UK government to the regions of Scotland, Wales and Northern Ireland) has allowed Scotland to pass legislation, separate to the rest of the UK, on devolved issues such as health, education and social care. Whilst Scottish alcohol policy emerged from reforms to address problem drinkers and individual responsibility (Katikireddi et al., 2014), most recent attempts at reform has seen Scotland pursue world-leading radical population strategies, such as Minimum Unit Pricing, a reduced alcohol limit for drivers, a ban on multi-buy alcohol promotions and the inclusion of a licensing objective regarding 'the protection and improvement of public health' (Licensing Scotland Act, 2005).

Supply side: alcohol outlet density

One further potential area for reform is in the supply and availability of alcohol. Supply controls may be enacted by restricting the physical availability of alcohol, either by limiting opening hours, days of sale or through the location of retail outlets. Three theories have been posited to explain why the physical availability of alcohol

may matter. The first theory, availability theory, consists of three possible stages as summarised by Livingston et al. (2007). Firstly, increased availability leads to increased consumption; secondly, as mean alcohol consumption increases so too do the number of heavy drinkers; and thirdly, heavy drinking is associated with adverse health and social outcomes, so as the number of heavy drinkers increases so too do these related problems. The second theory, market dynamics, refers to price competition and the notion that increased outlet density will increase the local competition between retailers, which will lead to price reductions and, in turn, increased levels of consumption. Previous research supporting this theory has shown that reduced price of alcohol is related to increased purchasing and consumption (Cook & Tauchen 1982). Analysis of the relationship between outlet density and price has shown that increased density of, in this case liquor stores, is associated with lower mean prices of alcohol (Treno et al. 2013). A third theory of social norms, proposes a more socio-structural effect at the neighbourhood level suggesting that individual drinking behaviour is shaped by attitudes, norms and behaviours of others in the neighbourhood. These collective norms may be shaped by outlet density and related marketing of products. In neighbourhoods of high density more frequent drinking behaviours may be observed and thus alcohol consumption is 'normalised' and such norms are established and perpetuated.

A large body of work has explored the relationship between alcohol outlet density (the concentration of outlets in a specific area), drinking behaviours and/or alcohol-related health outcomes. Research suggests an association between alcohol outlet density and increased levels of crime (Livingston 2008), domestic violence (Livingston 2011) and motor vehicle accidents (Cameron et al. 2012). Research also

shows an association between alcohol outlet density, morbidity and mortality. Mortality from alcohol-related harm is higher in areas of highest density compared to areas of low density with evidence from the UK (Richardson et al. 2015), Canada (Stockwell et al. 2011) and Switzerland (Spoerri et al. 2013). Morbidity, including hospitalisations, emergency department visits and injuries have also been found to be higher in areas of highest alcohol outlet density (Cunradi et al. 2012; Morrison et al. 2015; Richardson et al. 2015).

Within research focussing on alcohol outlet density, the tendency has been to treat the population as a homogenous group and measure the effects of the risk environment on the population as a whole. Whilst some research has begun to explore measured differences by subgroups (Ayuka et al., 2014), to date there has been little research exploring the interaction between alcohol outlet density, socio-economic status and alcohol-related outcomes. Most statistical models adjust for individual level characteristics and therefore the results that we see present an environmental effect that has, to some extent, controlled for underlying individual differences. This is despite evidence demonstrating an increased density of alcohol outlets in areas of higher social deprivation (Ayuka et al. 2014; Shortt et al. 2015). This outlet concentration in areas of high deprivation leads us to return to questions of vulnerability and to ask whether such density may have the same affect on all income groups. A new perspective would then explore how individuals with particular characteristics (e.g. sex or low-income) interact with the alcohol environment in different ways, and consider the implications for consumption patterns.

Emerging from a call to consider both social structures and human agency (Jones & Moon 1993), health geographers have begun to demonstrate that *"the impact of place is variable, depending on individual attributes"* (Curtis & Jones 1998), p.651). If individuals are situated in places where certain 'choices' are constrained by the broader structures (and reinforced by those in power) then distinctions need to be made between life choices and life chances (Abel & Frohlich 2012). Life choices, the decisions people make, are embedded in life chances, the opportunities that people have. Such opportunities may be shaped by social situations that include those at the individual level (e.g. socio-economic position, income, gender) and those at the aggregate level (e.g. pollution, presence or absence of civic amenities). Life chances can therefore both enable, and constrain choices, with both neighbourhood and individual level factors interacting to produce outcomes. Such an approach helps to develop the health and place literature by integrating social justice through an exploration, not just of whether or not contextual health risks are distributed inequitably, but also for whom these environments are more risky. A recent review identified the need for health geographers to provide greater attention to those with the greatest need and the fewest resources available to enhance their lives in order to positively affect their health and wellbeing (Rosenberg 2016). In this paper we address the risk environment through a primary focus on the local supply and availability of alcohol products (captured using a measure of outlet density) and the relationship with the harmful use of alcohol. In particular we explore vulnerability through the interaction between individual level socio-economic position and environmental risk to assess differential social vulnerability to such environments. Here we detail our approach to this analysis.

Methods

In order to explore the susceptibility of different socio-demographic groups and the alcohol risk environment, measures of alcohol outlet density for local areas across Scotland were constructed and appended to data on 28,765 respondents from the Scottish Health Survey Series (SHeS) (combined years 2008-2011), designed to document trends in the nation's health.

Alcohol outlet density (AOD) measures

The development of the AOD measures included three steps. Firstly, addresses and postcodes of all premises licensed to sell alcohol in 2012 (excluding temporary one off 'party/festival' licenses) were obtained from individual Scottish Liquor Licensing Boards (n = 32). These licenses were then divided into three categories; those licensed to sell alcohol for consumption on the premises (on-sales, n = 11,359), those licensed to sell alcohol for consumption off the premises (off-sales, n = 4,800) and finally a category containing all licenses (n = 15,159). Secondly, the locations of all outlets were mapped by postcode using ArcMap 10.1 geographic information system (GIS) software (23). Thirdly, kernel density estimation (KDE) was used to transform the locations into a density measure, separately for total, on-sale, and off-sale premises. The KDE technique required the definition of a cell size for the output density data (100m x 100m) and a search radius (we included three for sensitivity testing 400m, 800m, 1,000m). KDE transforms the point locations of premises to a smoothed continuous surface map which models the density of outlets for each cell. For each cell an assessment is made of the number and proximity of outlets within the specified radius. KDE includes a decay function meaning that outlets nearer the centre are

given more weight than those closer to the edge. Postcodes were then overlaid on the map as a layer in ArcGIS. A spatial join then allocated the density value to each postcode based on spatial location on the grid. The result is a proximity-weighted estimate of the density of alcohol outlets (separately for total, on-sales and off-sales) per km^2 for every postcode in Scotland (n = 152 400) (for more information on the method see (Shortt et al. 2016). Postcodes in Scotland have an average of 16 households and 36 residents. We report results for the 800m buffer, equivalent to a 10-minute walk for adults (King et al. 2012), as sensitivity analysis for the other buffers (800m and 1,000m) did not alter the results substantially. A more detailed description of the development of the three outlet density measures can be found elsewhere (Shortt et al. 2015).

The KDE-density values were categorised into five groups to minimise disclosure risk when linking these measures to the SHeS respondents. The first density category included all zero KDE-values. All remaining KDE-values above zero were grouped into equal quartiles. Based on their postcode of residence, these density categories were then linked to the SHeS respondents (n = 28,785). Due to small numbers of respondents in the zero-density category, this group was combined with the lowest density quartile. For subsequent analyses, this lowest outlet density category was used as the reference group. The postcodes of 20 respondents were uniquely identifiable, so they were excluded from subsequent analysis to protect confidentiality. The final linked dataset comprised 28,765 adults, for ethical and disclosure reasons any unique identifiers (including postcodes) were stripped from the data by the data holders before the linked dataset was returned to us.

Individual-level drinking outcomes

All individual-level drinking measures were derived from the SHeS. A detailed description of the SHeS methodology can be found elsewhere (Rutherford et al. 2013). The survey design was clustered collecting nationwide data from individuals living in private households randomly selected from address files within postcode sectors. Between 2008 - 2011 the survey was carried out annually, we combined the data for these years providing a large study sample enabling detailed analysis of population subgroups. The adult core-sample included all adults aged 16 and above (n = 28,765). All data from the core-sample was collected via personal interviewing.

Four widely used binary indicators of 'high-risk' drinking (as defined in the public health literature) were selected. These were based on a range of questions in the health survey that asked respondents to recount their drinking of various alcoholic beverages over the week prior to the interview. Based on this the number of units consumed over the 7 days could be calculated. The last variable refers to drinking experiences in the three months prior to interview. The variable 'exceeding recommendations' identified all respondents drinking above the weekly and/or daily recommended upper drinking limits (men = 21 units/week & 4 units/day; women = 14units/week & 3 units/day) (as defined at the time of this study, we recognise that the recommendations have since changed for men. 14 units is equivalent to six pints of average strength beer or ten small glasses of low strength wine). 'Harmful drinking' was chosen as an indicator of weekly excessive drinking (men 51+ units/week; women 36+ units/week), and 'binge drinking' as a measure of daily excessive drinking (men 8+ units/day; women 6+ units/day). 'Problem drinking' characterised the respondent's relationship with alcohol using the CAGE

questionnaire. This indicator is based on six variables including individual perceptions on the need to cut down, feeling ashamed, being annoyed by criticism about drinking, having shaky hands, drinking first thing in the morning, and being unable to stop drinking. Respondents were categorised as problem drinkers when they stated that they had experienced at least two of these drinking-related problems (Corbett et al. 2008).

Individual, household and area-level covariates

The SHeS includes a range of covariates known to be associated with alcohol consumption; individual (sex, age, religion, marital status, education); household (equivalized household income – adjusting income for household size and composition) and area-level (urban/rural status). We included each of these in our overall model. Equivalized household income was grouped into tertiles of: low (<£16 339), medium (£16 339–£31 707), high >£31 707) allowing sufficient numbers in each tertile to enable us to explore differences by income group. The Scottish Government urban/rural classification comprised primary cities (population >25,000), larger urban areas (population >10,000 and <25,000), small accessible and remote towns (population >3,000 and <10,000), as well as accessible and remote rural areas (population <3,000). Based on previous research, we know that there is as strong relationship between alcohol outlet density and area level deprivation in Scotland (Shortt et al. 2015), as we are controlling for individual level socioeconomic position we did not further control for area level deprivation, as argued elsewhere (Pearce et al. 2015).

Missing values and temporal coverage

Of the adult study sample included (n = 28, 765), 14 percent of the values were missing for household income (n=4164) and 13 percent of the values for problem drinking (n=3624). A smaller number of missing values were observed for some of the other variables included. In total 4178 cases were deleted resulting in n = 24,587 (the figure in table 1 differs slightly due to weighting). Excluding the missing values for age, gender, marital status, religion, urban/rural indicator resulted in proportional differences of <4.0 percent between the categories of the original and reduced sample. As the exclusion of the missing values did not change the composition of the sample considerably, we followed the example of previous research not to impute the missing values and report results based on the reduced sample (Carpenter & Kenward n.d.; Shortt et al. 2014; Vogl et al. 2012).

There is the temporal mismatch between the outlet density measure (2012) and the health surveys used (2008-2011). The change in the number of licensed premises over a short time period is likely however to be relatively small. We have since collected data for 2016 showing the national level change between 2012 and 2016 to be 3 percent over the 4-year period.

Analysis

All statistical analysis was conducted in Stata/IC 12.1. We first used descriptive statistics to examine the univariate associations between the four drinking outcomes, the covariates and the three AOD measures. Second, we ran fully adjusted binary logistic regression models (applying the complex survey design function accounting for the clustered sampling design and weighting for non-response) separately for each of our four outcome variables to quantify the magnitude of associations between

outlet densities (total, on-sale and off-sale) and different types of weekly and daily high-risk drinking. Additionally, we tested for trends in the associations between high-risk drinking and different outlet densities by modelling the four outlet density categories as continuous variables. We then calculated predicted probabilities of all outcome variables, respectively.

Finally, we ran fully adjusted interaction models to analyse whether the effect of AOD on individual-level drinking outcomes differed by equivalized household income group. The statistical significance of the interactions was assessed via a postestimation Wald test.

Results

In the week prior to data collection 43.5 percent of the respondents reported alcohol consumption 'exceeding recommendations', 4.5 percent reported 'harmful' drinking and 21.2 percent 'binge' drinking. In the three months prior to data collection 8.6 percent reported 'problem drinking'. There was a clear gradient in the prevalence of 'exceeding recommendations' and 'binge drinking' across the income groups; compared to those in the lowest income group, those in the highest income group were most likely to report exceeding recommendation (33.1 percent v 51.4 percent) and more episodes of binge drinking (16.6 percent v 26.6 percent). Those in the lowest income group were most likely to report 'harmful drinking' and 'problem drinking' although the trend observed was less clear (Table 1).

Table 1: Sample distributions and prevalence of high alcohol consumption, Scottish Health Survey 2008-2011

	†$n_{weighted}$	% of sample	†$n_{weighted}$	% Exceeding recommendations	†$n_{weighted}$	% Harmful drinking	†$n_{weighted}$	% Binge drinking	†$n_{weighted}$	% Problem drinking
Sex										
Male	11,872	48.3	5,732	48.3	681	5.7	3,057	25.8	1,274	10.7
Female	12,686	51.7	4,947	39.0	428	3.4	2,159	17.0	830	6.5
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic (*p*-value)			71.5	(*p*<0.01)	25.0	(*p*<0.01)	83.5	(*p*<0.01)	84.4	(*p*<0.01)
Age group										
16-24	3,362	13.7	1,445	43.0	256	7.6	964	28.7	444	13.2
25-34	3,912	15.9	1,990	50.9	148	3.8	1,173	30.0	497	12.7
35-44	4,512	18.4	2,257	50.0	207	4.6	1,185	26.3	405	9.0
45-54	4,546	18.5	2,297	50.5	228	5.0	1,093	24.1	397	8.7
55-64	3,752	15.3	1,598	42.6	154	4.1	579	15.4	238	6.3
65+	4,474	18.2	1,092	24.4	117	2.6	221	4.9	123	2.8
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic (*p*-value)			254.7	(*p*<0.01)	94.4	(*p*<0.01)	243.3	(*p*<0.01)	41.8	(*p*<0.01)
Religion										
None	10,307	42.1	5,036	48.9	580	5.6	2,708	26.3	1,063	10.3
Church of Scotland	7,807	31.9	3,116	39.9	300	3.8	1,356	17.4	536	6.9
Roman Catholic	3,646	14.9	1,645	45.1	149	4.1	805	22.1	340	9.3
Other Christian	2,076	8.5	732	35.2	68	3.3	289	13.9	133	6.4
Other	635	2.6	137	21.6	11	1.7	47	7.4	29	4.6

Total	*24,471*	*100.0*	*10,665*	*43.6*	*1,107*	*4.5*	*5,205*	*21.3*	*2,102*	*8.6*
Missing	86	0.3	653	2.7	361	1.5	475	1.9	3,425	13.9
Design-based F-statistic (*p*-value)			100.9	(*p*<0.01)	110.9	(*p*<0.01)	107.4	(*p*<0.01)	30.8	(*p*<0.01)
Marital status										
Single	5,601	22.8	2,465	44.0	404	7.2	1,565	28.0	777	13.9
Married/living as married	15,292	62.3	7,033	46.0	549	3.6	3,168	20.7	1,059	6.9
Divorced/separated/dissolved civil partnership	2,013	8.2	846	42.0	114	5.7	399	19.8	209	10.4
Widowed/surviving partner	1,645	6.7	335	20.4	42	2.6	83	5.0	59	3.6
Total	*24,552*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	5	<0.1	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic (*p*-value)			194.7	(*p*<0.01)	81.7	(*p*<0.01)	145.3	(*p*<0.01)	41.7	(*p*<0.01)
Highest educational qualification										
Higher National Diploma or higher	6,304	25.8	1,900	30.1	236	3.7	782	12.4	407	6.5
Standard or higher grade	9,125	37.3	4,221	46.3	549	6.0	2,359	25.9	963	10.6
None or other school	9,032	36.9	4,542	50.3	325	3.6	2,066	22.9	731	8.1
Total	24,461	*100.0*	*10,663*	*43.6*	*1,109*	4.5	*5,207*	21.3	*2,101*	8.6
Missing	96	0.4	655	2.7	359	1.5	474	1.9	3,426	13.9
Design-based F-statistic (*p*-value)			256.3	(*p*<0.01)	184.0	(*p*<0.01)	230.2	(*p*<0.01)	92.8	(*p*<0.01)
Equalised household income group (tertiles)										
1 (<£16,339)	7,783	31.7	2,578	33.1	392	5.0	1,293	16.6	759	9.8
2 (£16,339-£31,707)	8,122	33.1	3,398	41.8	315	3.9	1,625	20.0	635	7.8
3 (>£31,707)	8,652	35.2	4,703	54.4	403	4.7	2,297	26.6	710	8.2
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic (*p*-value)			95.3	(*p*<0.01)	7.1	(*p*<0.01)	30.8	(*p*<0.01)	51.0	(*p*<0.01)
Urban/rural indicator[‡]										
Primary cities (population >125,000)	9,283	37.8	4,228	45.6	422	4.6	2,186	23.6	922	15.0
Urban (population >10,000 & ≤125,000)	7,483	30.5	3,234	43.2	372	5.0	1,566	20.9	644	14.0

Small accessible towns (population >3,000 & ≤10,000)	2,270	9.2	926	40.8	101	4.4	457	20.1	181	13.6
Small remote towns (population >3,000 & ≤10,000)	854	3.5	338	39.6	44	5.1	172	20.2	60	13.1
Accessible rural (population <3,000)	3,041	12.4	1,316	43.3	112	3.7	593	19.5	209	12.2
Remote rural (population <3,000)	1,626	6.6	638	39.2	59	3.6	241	14.8	88	12.2
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic *(p*-value)	_	_	3.0	(*p*<0.01)	1.2	(*p*=0.31)	4.9	(*p*<0.01)	5.5	(*p*<0.01)
Total alcohol outlet density										
AOD 1 (lowest AOD, including areas with AOD = 0)	7,775	31.7	3,382	43.5	313	4.0	1,543	19.8	560	7.2
AOD 2	6,501	26.5	2,704	41.6	266	4.1	1,296	19.9	521	8.0
AOD 3	5,932	24.2	2,538	42.8	278	4.7	1,280	21.6	547	9.2
AOD 4 (highest AOD)	4,349	17.7	2,055	47.3	252	5.8	1,096	25.2	476	11.0
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic *(p*-value)			3.3	(p<0.01)	2.2	(*p*<0.05)	4.9	(*p*<0.01)	7.3	(*p*<0.01)
On-sale alcohol outlet density										
AOD 1 (lowest AOD, including areas with AOD = 0)	8,815	35.9	3,764	42.7	369	4.2	1,750	19.9	635	7.2
AOD 2	6,170	25.1	2,582	41.8	247	4.0	1,244	20.2	540	8.8
AOD 3	5,516	22.5	2,416	43.8	249	4.5	1,198	21.7	487	8.8
AOD 4 (highest AOD)	4,056	16.5	1,918	47.3	244	6.0	1,023	25.2	442	10.9
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*
Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic *(p*-value)	_	_	3.0	(p<0.05)	2.5	(*p*<0.05)	4.4	(*p*<0.01)	5.0	(*p*<0.01)
Off-sale alcohol outlet density										
AOD 1 (lowest AOD, including areas with AOD = 0)	8,675	35.3	3,825	44.1	353	4.1	1,731	20.0	624	7.2
AOD 2	5,834	23.8	2,432	41.7	246	4.2	1,185	20.3	489	8.4
AOD 3	5,568	22.7	2,351	42.2	248	4.5	1,189	21.4	491	8.8
AOD 4 (highest AOD)	4,479	18.2	2,072	46.3	262	5.9	1,110	24.8	499	11.1
Total	*24,557*	*100.0*	*10,679*	*43.5*	*1,109*	*4.5*	*5,215*	*21.2*	*2,104*	*8.6*

Missing	0	0.0	639	2.6	359	1.5	465	1.9	3,423	13.9
Design-based F-statistic (*p*-value)	_	_	4.3	(*p*<0.01)	2.6	(*p*<0.05)	6.5	(*p*<0.01)	7.6	(*p*<0.01)

[†]Totals & percentages weighted for non-response.

[‡]Accessible small towns and rural areas are within a 30-minute drive of a settlement of 10,000 or more. For remote small towns and rural areas the driving time exceeds 30 minutes.

The relationships between drinking outcomes and AOD were also as expected. For all drinking variables, we observed a positive trend, indicating that that higher outlet density was associated with increased probabilities of high-risk drinking (Table 1). For all outcomes, across all categories of outlet density (total, on-sales and off sales) we observed the expected gradient; higher reporting in areas of highest density. For total outlet density, 'exceeding recommendations' increased from 43.5 percent to 47.3 percent (p <0.01), 'harmful drinking' increases from 4.0 percent to 5.8 percent (p <0.05), 'binge drinking' increases from 19.8 percent to 25.2 percent (p <0.01) and 'problem drinking' increases from 7.2 percent to 11.0 percent (p <0.01).

Multivariate models

Results from the fully adjusted models (adjusted for age, sex, religion, marital status, household income, education, neighbourhood urban/rural status) are presented in Table 2. The table presents the predicted probabilities of all four outcomes in relation to AOD for each category of outlet type. For total outlet density, we observe a positive gradient in the probability of reporting all outcome variables. Compared to those living in areas of low density, in areas of highest density we see the probabilities of reporting exceeding recommendations increase by 4 percent, of harmful drinking increase by 1 percent, of binge drinking by 3 percent and of problem drinking by 2 percent. All of these results reached statistical significance and all trends are positive and significant. These results are reflected in on-sale outlet density with exceeding recommendations increasing by 5 percent in areas of highest density, harmful drinking by 1 percent, binge drinking by 4 percent and problem drinking by 2 percent. Again, all reach statistical significance with significance positive trends.

Results for off-sales are weaker with only harmful drinking and binge drinking showing significant increase (1 percent and 2 percent respectively) and only binge drinking showing significant trend across the density groups

Table 2 Summary non-stratified fully adjusted models[‡]

	Exceeding recommendations			Harmful drinking			Binge drinking			Problem drinking		
		95% CI			95% CI			95% CI			95% CI	
	dy/dx[†]	lower	upper	dy/dx[†]	lower	upper	dy/dx[†]	lower	upper	dy/dx[†]	lower	upper
Total alcohol outlet density (AOD)												
1 (lowest, including areas with AOD = 0) [reference group]												
2	0.00	-0.02	0.02	0.00	-0.01	0.01	0.00	-0.02	0.02	0.00	-0.01	0.02
3	0.02	-0.01	0.04	0.00	-0.01	0.02	***0.02***	0.00	0.04	0.01	0.00	0.03
4 (highest AOD)	**0.04**	0.01	0.06	***0.01***	0.00	0.03	**0.03**	0.01	0.05	***0.02***	0.00	0.03
Trend	**0.01**	0.01	0.02	***0.00***	0.00	0.01	**0.01**	0.00	0.02	***0.01***	0.00	0.01
On-sale alcohol outlet density (AOD)												
1 (lowest, including areas with AOD = 0) [reference group]												
2	0.01	-0.01	0.03	0.00	-0.01	0.01	0.01	-0.01	0.02	***0.02***	0.00	0.03
3	***0.02***	0.00	0.04	0.00	-0.01	0.01	***0.02***	0.00	0.04	0.01	0.00	0.03
4 (highest AOD)	**0.05**	0.02	0.07	***0.01***	0.00	0.03	**0.04**	0.01	0.06	**0.02**	0.01	0.04
Trend	**0.01**	0.01	0.02	***0.00***	0.00	0.01	**0.01**	0.01	0.02	**0.01**	0.00	0.01
Off-sale alcohol outlet density (AOD)												
1 (lowest, including areas with AOD = 0) [reference group]												
2	-0.01	-0.03	0.01	0.00	-0.01	0.01	0.00	-0.02	0.02	0.00	-0.01	0.02
3	0.01	-0.02	0.03	0.00	-0.01	0.01	0.01	-0.01	0.03	0.00	-0.01	0.02
4 (highest AOD)	0.02	0.00	0.05	***0.01***	0.00	0.02	***0.02***	0.00	0.04	0.01	0.00	0.03
Trend	0.01	0.00	0.02	0.00	0.00	0.01	***0.01***	0.00	0.01	0.00	0.00	0.01

† **p < 0.01**; ***p < 0.05***

‡ Adjusted for age, sex, religion, marital status, household income, education, neighbourhood urban/rural status

Interaction models

To explore whether each income group was equally affected by outlet density across our four outcomes, we examined the interactions between AOD and our outcomes, stratified by tertiles of household income (Figures 1 to 4). As there are four outcomes across three outlet density categories (total sales, on-sales and off-sales) we present the results for total outlet density and where they differ for either on-sales or off-sales we note this. Significant results are those for which the 95 percent confidence intervals do not overlap.

Exceeding recommendations

Across all AOD categories the highest income groups are most likely to exceed recommendations. The probability of exceeding recommendations increases for all income groups with increasing AOD (Figure 1). Most of the differences between the income groups reach statistical significance (95 percent confidence intervals [CIs] do not overlap). It is, however, clear that those in the lowest income tertile are most strongly affected by outlet density for this outcome. The probability of exceeding recommendations rose from 36.6 percent for the lowest income tertile in areas of lowest density to 43.3 percent in areas of highest density, a significant increase of 6.7 percent compared to 3.1 percent increase in the mid tertile and a 2.1 percent increase in the highest income tertile (both non-significant). Whilst the gap between the lowest and highest income tertiles reduces from 14.3 percent in the lowest density areas to 9.7 percent in the highest density areas, this is largely due to the sharp increase in those in the lowest income tertile exceeding recommendations rather than a reduction in any income tertile. Postestimation Wald tests were significant ($p < 0.05$).

Considering AOD subcategories, a similar pattern is reflected for on-sales and off-sales where there is a clear positive gradient in the risk of exceeding recommended consumption as AOD rises across all of the income tertiles, and again the gradient is steepest for the lowest income tertile.

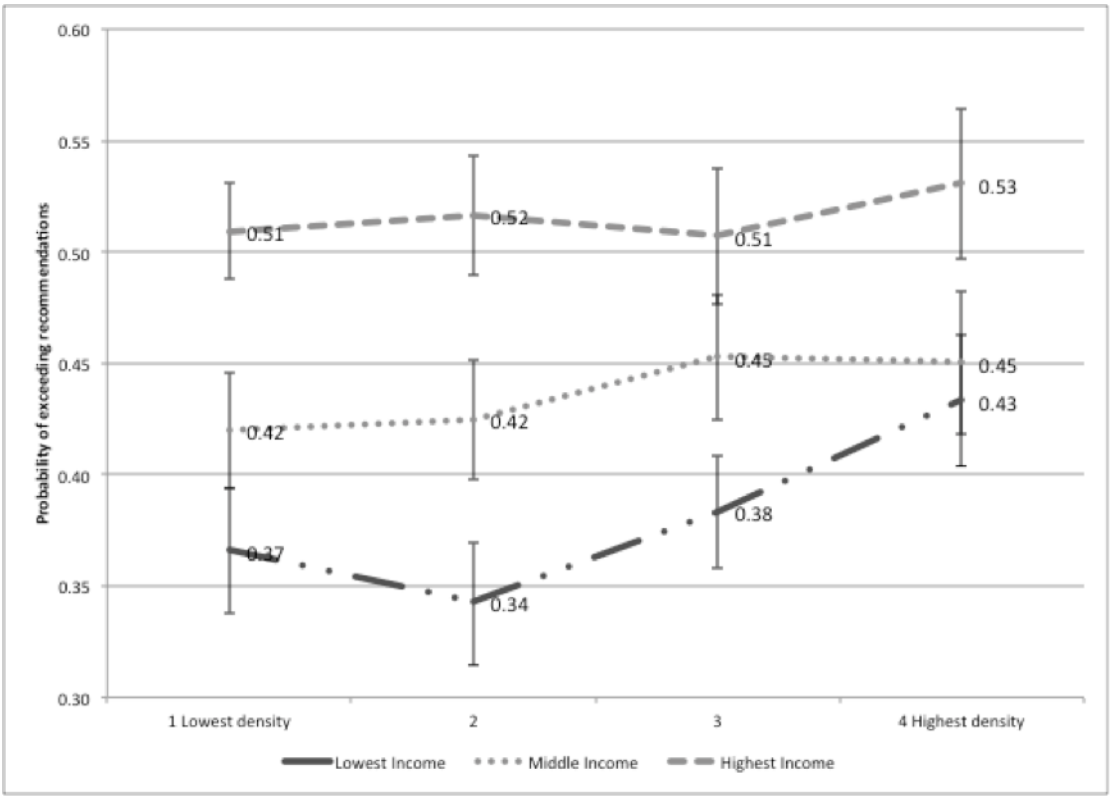

Figure 1: Adjusted[a] interactive effects of total alcohol outlet density (AOD)[b] on individual-level reporting of exceeding recommendations[c] by household income, Scottish Health Survey 2008-2011 ($n_{weighted}$ = 24,116).

Note: [a]model includes design variables (to account for sample stratification and nonresponse), alcohol outlet density and equalised household income, controlling for sex, age, religion, marital status, education and neighbourhood urban/rural status. [b]AOD 1: median of kernel density estimation values (KDE) = 0,6/km^2; AOD 2: median KDE = 3,8/km^2; AOD 3: median KDE = 7,5/km^2; AOD 4: median KDE = 23,4/km^2; [c]Reference group: respondents not exceeding the drinking recommendations.

Harmful drinking

As with exceeding recommendations, Figure 2 shows that the largest increase in the predicted probabilities of harmful drinking are seen in the lowest income tertile. For

the highest income tertile there is a non-significant reduction in the probability of harmful drinking, falling from 5.1 percent in areas of lowest density to 4.3 percent in areas of highest density. Conversely for the lowest income tertile this rises from 4.3 percent in the lowest density group to 7.1 percent in the highest density group (though this is non-significant).

Again, the pattern is broadly similar for other density categories. For on-sales the probability of harmful drinking rises for the lowest income tertile (4.1 percent to 7.7 percent, significant) and falls for the highest income tertile (5.2 percent to 4.2 percent non-significant). For off-sales once again the probability rises for the lowest income tertile (3.5 percent to 6.9 percent significant) and falls for the highest income tertile (5.7 percent to 4.4 percent, non-significant). Again, all postestimation Wald tests were significant ($p = < 0.05$).

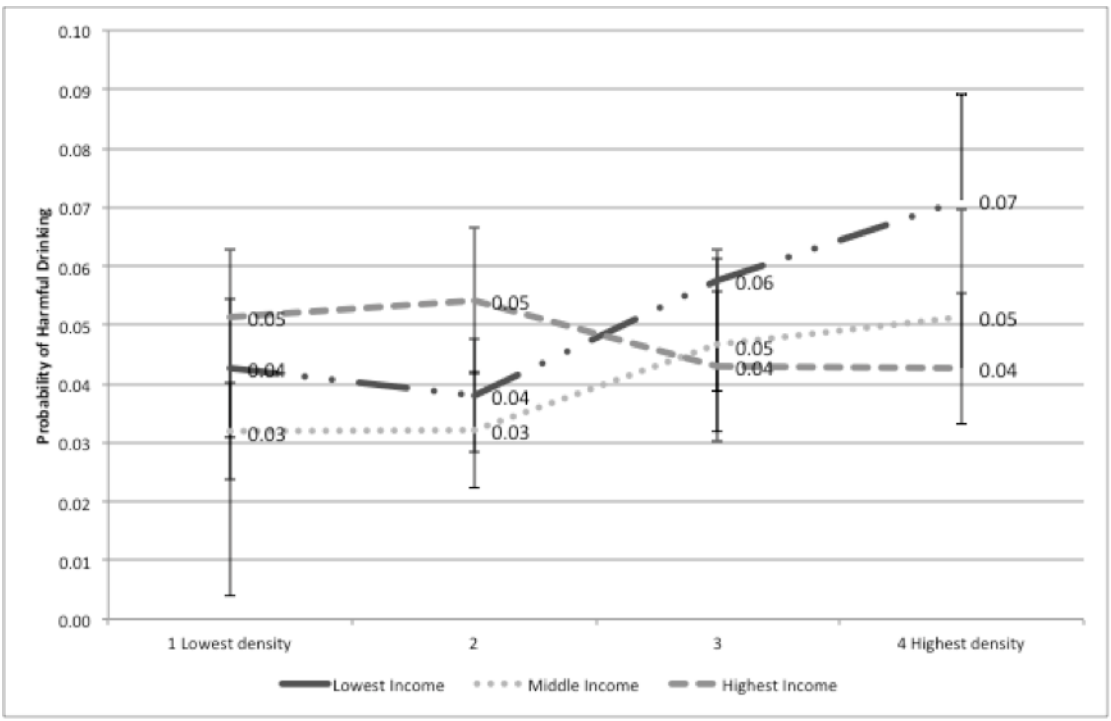

Figure 2: Adjusted interactive effects of total alcohol outlet density (AOD) on individual-level reporting of harmful drinking[c] by household income, Scottish Health Survey 2008-2011 ($n_{weighted}$ = 24,279).

Adjustments and AOD ranges as per Figure 1. Reference group: those not reporting harmful drinking.

Binge drinking

The probability of binge drinking increases significantly across total outlet density groups for the lowest income tertile (17 percent to 24 percent) but remains relatively static for the highest income tertile (24 percent to 25 percent). For on-sales and off-sales the patterns are similar, the probability of binge drinking in the lowest income tertile rises significantly from 15 percent in the lowest density group to 23 percent in the highest density group for on sales and from 18 percent to 23 percent for off-sales with little or no change in the highest income tertile. Postestimation Wald tests were significant ($p = < 0.05$).

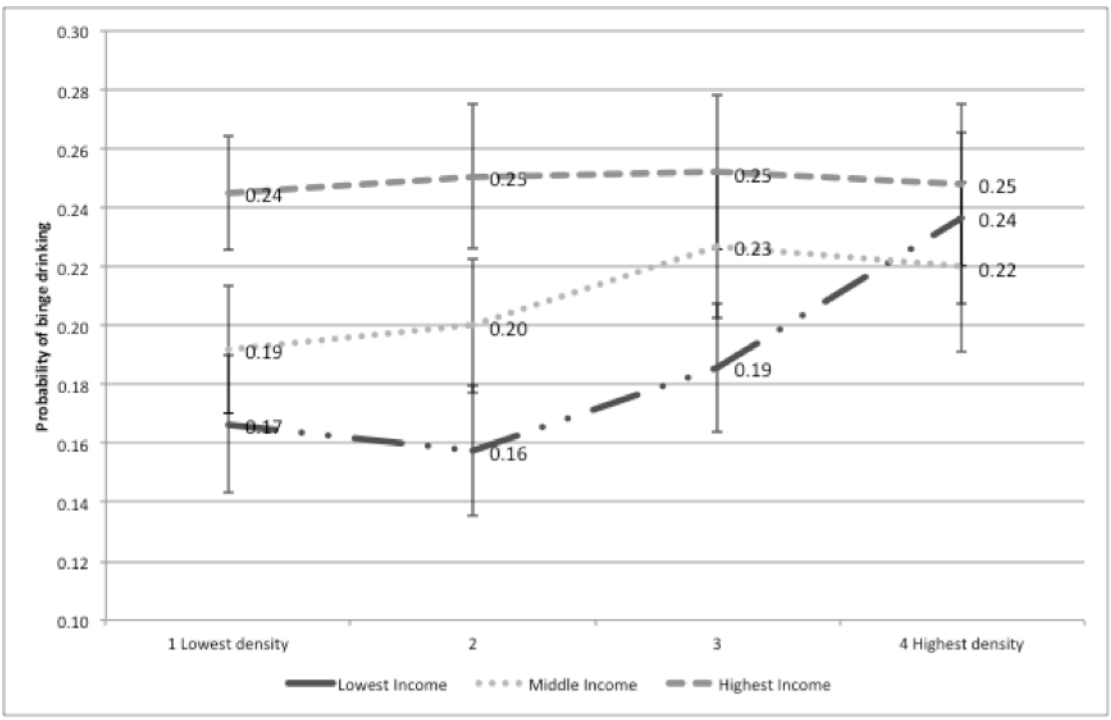

Figure 3: Adjusted interactive effects of total alcohol outlet density (AOD) on individual-level reporting of binge drinking[c] by household income, Scottish Health Survey 2008-2011 ($n_{weighted}$ = 24,237).

Adjustments and AOD ranges as per Figure 1. Reference group: respondents not reporting binge drinking.

Problem drinking

Unlike the other outcomes, the probability of problem drinking is highest for those in the lowest income tertile across all total density groups. For the lowest income group the probability of problem drinking rises significantly from 10 percent to 15 percent. For the highest income tertile we see a non-significant fall (9 percent to 8 percent). Both the on-sales and off-sales patterns reflect the total sales pattern. For off-sales the predicted probability for the lowest income tertile in the highest density group (15 percent) is almost double that of the highest income tertile in the highest density group (8 percent). Postestimation Wald tests were significant (p = < 0.05).

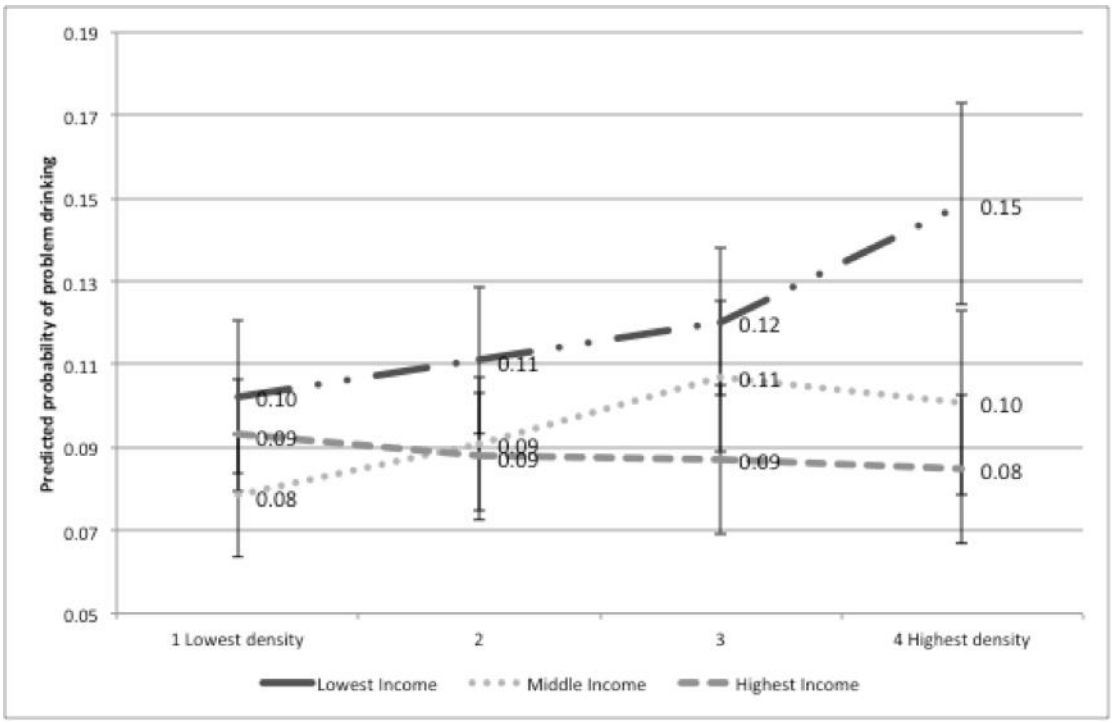

Figure 4: Adjusted[a] interactive effects of total alcohol outlet density (AOD)[b] on individual-level reporting of problem drinking[c] by household income, Scottish Health Survey 2008-2011 ($n_{weighted}$ = 20,914).

Adjustments and AOD ranges as per Figure 1. Reference group: respondents not reporting problem drinking.

Discussion

In this paper we examined the alcohol risk environment. In particular, we examined whether those living in neighbourhoods of high alcohol outlet density exhibit different patterns of alcohol consumption compared to those in areas of low alcohol outlet density. We also explored whether or not the risk environment shapes consumption patterns equally amongst all socioeconomic groups. We focussed on four drinking behaviours; 'exceeding recommendations', 'harmful' drinking, 'binge' drinking and 'problem' drinking. In univariate analysis we found that the probability of reporting such behaviours increases with increased outlet density. In fully adjusted models this increase remained for all outcomes, with increasing density of both total and on-sales outlets and for harmful drinking and binge drinking with increasing density of off-sales outlets. These findings suggest that alcohol outlet density is associated with greater probability of reporting episodes of heavier drinking or problem drinking.

To explore whether or not all income groups were equally affected by outlet density we examined the interactions between outlet density and household income tertiles across all four outcomes. We found evidence that those in the highest income groups are more likely to report binge drinking or exceeding recommendations in all density categories. Those in the lowest income groups were more likely to report problem drinking across all density categories. For harmful drinking there was a different pattern between the density categories with probability highest for the highest income group for areas of low density and highest for the lowest income group in areas of highest density. However, when we explore the impact of increasing alcohol outlet density on drinking outcomes by income group we see different results for high-income and low-income groups. For those in the highest income group the probability of all outcomes remained relatively static as density increased. However, for those in

the lowest income group outlet density mattered with the probability of all outcomes rising as density increased (significant for exceeding recommendations, binge drinking and problem drinking). In particular, in the highest density neighbourhoods those on the lowest incomes have the highest levels of harmful drinking and problem drinking. These results suggest that lower income groups may be disproportionately affected by outlet density.

Evidence points to the features of the risk environment having an influence on health, health behaviours and health inequalities. It is clear that risk environments may not affect us all equally and that there may be socially differentiated vulnerability to such environments. In alcohol research there is limited evidence on how place-based influences may differ between different sociodemographic groups. This research addresses that in an original approach and extends previous work that explored the differential impact of the alcohol environment on gender, age and ethnicity (Ayuka et al 2014). In a significant addition to the literature we have shown that low-income respondents are more vulnerable to alcohol outlet density than higher income groups. There are many possible reasons for this including mobility constraints and daily patterns of movement. Using data from the Whitehall study of British civil servants, Stafford and Marmot (2003) have argued that the impact of neighbourhood deprivation is greater for those in lower socioeconomic positions. Further research has shown that lower socio economic groups may spend more time in their local neighbourhoods (Forrest & Kearns 2001), tend to walk around their neighbourhoods more (Macintyre & Ellaway 1998), travel shorter distances on a daily basis (Morency et al. 2011), be more reliant on resources in their local vicinity (Ivory et al. 2015) and that their health ‘choices’ may be more readily influenced by the environments in

which they live (Shortt et al., 2014). As a result those from lower socioeconomic groups may be more constrained, and indeed bounded by, their environments and thus more vulnerable to the risks presented. Furthermore, those in lower income groups may see alcohol as a coping mechanism for psychological distress (Mulia et al. 2008) and an increased availability of alcohol may contribute. Individuals of differing social groups may therefore be both differentially exposed to risk environments by type, but also differentially reliant on their own residential environments in a temporal sense – a double burden of low income and risk environments. Linked to Max Weber's notions of 'life chances' residential neighbourhoods can therefore be seen as spaces that constrain or enable choices, with individual circumstances, in this case socio-economic status, interacting with context (alcohol outlet density) to affect behaviour and health outcomes.

This convergence of low socio-economic position, the risk environment and vulnerability is troubling, given the persistent health inequalities in Scotland and evidence of the alcohol harm paradox. These results suggest that behaviour-led interventions that ignore the broader context in which behaviours take place, are unlikely to make substantial improvements to population health or reduce inequalities. Drawing upon tobacco control research we know that such 'downstream' policies, such as media campaigns, risk increasing social inequalities (Hill et al. 2014). Instead, as highlighted by Rose (1992), radical policies are required, policies that address inequalities; both the drivers of unequal risk environments and the social, political and economic drivers of persistent poverty.

Whilst considering structural change we must also consider the broader drivers of risk environments and in particular manufactured risk. The risk environments explored in

this paper are shaped by wider economic and social determinants. Adapting the analogy of a 'vector', Gilmore et al. (2011) identify the role of the host (the consumer), agent (the product, in this case alcohol), the environment (e.g. density) and the disease vector (the corporations) in shaping the risk environment. This analogy has been used effectively in tobacco control, leading to a concerted effort to explore and restrain corporate influence (e.g. Article 5.3 of the Framework Convention on Tobacco Control). Despite claims regarding 'tobacco exceptionalism', arguments can also be made with respect to alcohol availability contributing towards the risk environment for alcohol consumption. Here we concur with Gilmore et al. (2011) who argue that Big Alcohol (and Big Food) act in similar ways to Big Tobacco (e.g. privatising risk and focussing on personal responsibility, individual liberty and self-regulation) making it more difficult to enact effective, 'radical', health policies concerning availability and supply.

Our research has some limitations. First, our database of alcohol outlets allowed us to distinguish between on-sales and off-sales premises and to group these into a measure for total outlet density. Whilst this allowed us to test for differences between on-sales and off-sales the measure itself could be seen as rather crude. The category of on-sales includes all premises that are licenced to sell alcohol for consumption on the premises. Such premises range from restaurants to pubs, bars and large vertical drinking establishments (such as a club with 4 floors and a bar on each floor). We have no information on size of premises, opening hours or nature of the establishment. To date the majority of the research in this area has explored differences between on-sales and off-sales outlet density but there has been little, if any, exploration of the association between type of on-sales premise, alcohol related harm and drinking behaviours. In contrast research exploring assault and alcohol

outlet density has assessed whether or not all types of licensed premises are equal contributors, concluding that hotels and nightclubs (Briscoe & Donnell 2003) brand bars and off-sales (Gruenewald & Remer, 2006) were the most problematic premises. Future work could explore how distinction by premise type is related to consumption patterns. Second, our analysis was cross-sectional, measured at one point in time. As such we can report only associations and whilst we can infer causation, we cannot prove it. In order to determine whether or not there is a causative pathway we would need, at the very least, to explore these results over time and utilise change in the alcohol environment as a 'natural experiment'. We intend to do this in a future programme of work. Third, there may be an element of underrepresentation of alcohol consumption in the health survey, both through underreporting of alcohol consumption and under-representation of groups associated with heavy drinking (men, younger population and those from more deprived groups) (Gray et al. 2013). As such we may be understating the strength of the association between outlet density and drinking behaviours, particularly in relation to off-sales where low prices may promote excessive drinking (Pattoni et al. 2007) and where previous research has found strongest associations between off-sales density and alcohol related harm (Richardson et al., 2014). Finally, our research explored the individual's home environment. We know that individuals move between neighbourhoods and future analysis could also include non-residential environments (Perchoux et al. 2013).

Reducing alcohol related harm is a key goal in public health but has been described as a 'wicked issue' that requires complex solutions (Hunter 2009). Any privatisation of risk will inevitably lead to a focus on lifestyle change and given that it has been argued that our level of societal acceptability for alcohol risk is high, it is particularly difficult to shift the neoliberal rhetoric from individual blame to societal

responsibility. Whilst such a shift towards more radical interventions may be apparent in some national contexts, Scotland as an example, there are many others who continue to argue the case for personal responsibility. In this paper however we have challenged the notion of personal responsibility by showing that the environment matters and that the alcohol environment has a differential effect upon social groups, potentially contributing to socioeconomic inequalities in health outcomes. Inevitably this then begs the question 'for whom does the environment matter?' (Forest and Kearns, 2001, p2136).

Neighbourhoods, as opportunity structures (Macintyre et al. 2002), may be more or less conducive to health but there are policy options to shape and change the risk environment. In the 'Global Strategy to Reduce the Harmful Use of Alcohol' the World Health Organisation identify 10 recommended target areas for policy options and interventions (WHO 2010). The more radical strategies, those that aim to change the context in which drinking behaviours are shaped, include action on the availability of alcohol, the marketing of alcohol and the price of alcohol. Scotland has just become the first country in the world to establish Minimum Unit Pricing. Such a radical move, after a hard fought battle through the courts, should be applauded. Price however is not a magic bullet and will not solve all alcohol related problems immediately. Further interventions, at a population level, require us to consider the places in which alcohol is consumed and in which health related outcomes are realised. The interaction between place and behaviour, and importantly household income, is critical and as such the vectors of these risk environments need to be challenged.

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Author professional/contact information

Niamh K Shortt is a Reader in human geography and co-director of the Centre for Research on Environment, Society & Health in the School of GeoSciences, University

of Edinburgh, EH8 9XP, United Kingdom. Email: niamh.shortt@ed.ac.uk Her research interests include exploring the relationship between health behaviours, the environment and health inequalities.

ESTHER RIND is a researcher and project manager at the Institute of Occupational and Social Medicine & Health Services Research, University Hospital Tuebingen, Wilhelmstr. 27, 72074 Tuebingen., Germany. E-mail: esther.rind@med.uni-tuebingen.de. Her research interests include the study of health behaviours & health inequalities and the prevention of mental distress for personnel working in the health care system.

Jamie Pearce is Professor of Heath Geography and co-Director of the Centre for Research on Environment, Society & Health in the School of GeoSciences, University of Edinburgh, EH8 9XP, United Kingdom. Email: jamie.pearce@ed.ac.uk His research interests include geographical explanations for health inequalities and behaviours including the consumption of tobacco and alcohol.

RICHARD MITCHELL is Professor of Health and Environment, and leads the Neighbourhoods and Communities research programme, at the MRC/CSO Social and Public Health Sciences Unit, University of Glasgow, G2 3QB. He is also a co-Director of the Centre for Research on Environment, Society & Health Email: Richard.Mitchell@glasgow.ac.uk. His research interests include how social and physical environment can protect health and narrow health inequalities, the health impacts of natural environments, and the application of complex systems approaches to these topics.

Professor Sarah Curtis is Honorary Professor, University of Edinburgh and Professor Emeritus, Durham University, UK. Email: s.e.curtis@durham.ac.uk. She specialises in geographies of health and health care.